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Compliance in own-check systems poses challenges in small-scale slaughterhouses

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Abstract

Small-scale slaughterhouses (SHs) face many challenges, not least due to the requirements of food safety legislation. Food business operators' (FBOs') own-check system is very important for food safety, but its proper implementation can be quite difficult and laborious for small-scale SHs. In the European Union, the importance not only of food safety but also facilitation of local food production, including small-scale slaughtering, is highlighted. The aim of our study was to assess compliance with legislation of own-check systems, including six own-check programmes and HACCP, in small-scale SHs. The FBOs' opinions of the implementation of own-check systems were also sought to elucidate possible obstacles in implementation. Our results showed that the best compliance in own-check programmes was achieved in temperature of storage rooms and traceability. FBOs also evaluated these programmes as necessary. However, FBOs' perceived necessity of own-check programmes did not always lead to compliance, as was the case with labelling and HACCP. Instead, in HACCP laboriousness and compliance showed a negative correlation ($p < 0.05$). In addition to laboriousness, costs of own-check programmes, specifically concerning microbiological sampling requirements, appeared to influence compliance, with many of the small-scale SHs poorly following sampling requirements. FBOs also noted the high costs of the non-edible by-product programme. Moreover, the results show that official veterinarians' assessment of compliance was significantly higher than that of the researcher, which warrants further investigation. This study reveals that many small-scale SHs in Finland struggle with food safety requirements. Amendments of some of the requirements to ease the burden of FBOs are proposed. HACCP in particular is suggested to be simplified. In addition, ways to improve food safety and official control in small-scale SHs are discussed.

Keywords: Small-scale slaughterhouse; Own-check programme; HACCP; Compliance, Official control; Inspection

1. Introduction

In recent years, the European Union (EU) rural development policy has paid more attention than previously to local food production systems and short food supply chains. Both of these factors may support farmers' economy, give consumers an opportunity to obtain fresh and local products, create social cohesion at the local level, and reduce environmental impact (EC 1305/2013; Kneafsey et al., 2013). Small-scale slaughterhouses (SHs) are a component of local food production systems. They also represent short food supply chains because many of them sell their products on site and animals that are slaughtered in small-scale SHs may be from their own farm. Improving the opportunities of small-scale SHs to operate should therefore be one of the strategic aims for EU countries.

In Finland, promoting local production has been taken into the government's official policy. For that reason, the national food safety legislation is further developed so that the flexibility allowed in EU legislation concerning local production, including small-scale SHs, is fully utilized and more efficient training and advice are provided on food legislation (Ministry of Agriculture and Forestry, 2013). The number of approved small-scale SHs in Finland in 2015 was 52 of which 41 were active (Evira, 2015a). These measures aim at improving the possibility for pre-existing small-scale SHs to operate and creating new small-scale SHs (Ministry of Agriculture and Forestry, 2013).

Most food business operators (FBOs), including small-scale SHs, are required to comply with general and specific hygiene requirements (EC 852/2004; EC 853/2004) and maintain a permanent

procedure based on HACCP principles (EC 852/2004). In addition, requirements on traceability must be met by FBOs (EC 178/2002). These legislative requirements are implemented in EU with an own-check system, which consists of own-check programmes and HACCP (Stolle, 2014). Own-check programmes comprise, for instance, temperature and non-edible by-products and traceability programmes. The own-check system is audited by official food control to ensure that the FBO is complying with legislation.

Complying with food safety legislation appears, however, to be challenging for small-scale SHs (Haltiala, 2013; Charlebois & Summan, 2014). In EU countries, non-compliances have been found in small-scale SHs in audits conducted by the Food and Veterinary Office (FVO) of the European Commission in 2013 and 2014 (FVO, 2013a, 2013b, 2013c & 2014a). Non-compliances have also been observed in small-scale SHs in Finland in official controls in 2012-2013. Non-compliances have been seen, for instance, in monitoring of carcass hygiene, updating of own-check plan, microbiological sampling, and own-check of non-edible by-products (FVO, 2013a, 2013b, 2013c & 2014a; Haltiala, 2013). The legislative requirements are apparently not always easy to fulfil in large-scale SHs either, as similar types of non-compliances have been observed in several EU countries (FVO 2011, 2014b; Luukkanen & Lundén, 2016).

Small-scale SHs' challenges in complying with food safety regulations may arise for several reasons. For example, systems related to demands for food safety can be perceived as prohibitive burdens by small firms affecting the implementation of own-check systems (Jayasinghe-Mudalige & Henson, 2007). Furthermore, failure to understand the importance of the food safety requirements can lead to deficiencies in compliance (Yapp and Fairman, 2006). Also inconsistencies in official control and costs of implementing the requirements can affect the

compliance (Charlebois & Summan, 2014). Non-compliances with food safety legislation and reasons leading to these non-compliances in small-scale SHs should be investigated in order to develop the requirements for small-scale SHs and facilitate their operations.

The aims of our study were to determine on site how small-scale SHs' own-check systems meet the requirements of the food safety legislation as evaluated by the researcher. The official veterinarians (OVs') perceptions of the compliance were also investigated because official control may have a significant role in small-scale SHs' own-check systems. A further aim was to investigate reasons for possible poor compliance by mapping the FBOs' opinions about the own-check systems. The results can be used in improving the possibilities of small-scale SHs to operate by training FBOs in food safety, increasing the knowledge of OVs of small-scale SHs' requirements, and uncovering possible regulative problems.

2. Material and methods

2.1. Selection of small-scale slaughterhouses

Fourteen small-scale SHs were chosen to the study based on their activities, location, and willingness to participate (Table 1). Earlier compliance with food safety requirements was not a selection criteria. The activities included meat cutting and preparation of meat or minced meat in all small-scale SHs. Meat products were produced in five of them. Participating small-scale SHs were located in all Regional State Administrative Agencies, except Lapland, and represented 34% of all active small-scale SHs in 2015 (Supp. Fig. 1). The study included 56% of all active small-scale SHs producing minced meat or meat preparations and 38% of active small-scale SHs producing meat products (Table 1). Number of slaughtered animal units ranged between 35 and 900 with a median of 270 (one animal unit = one bovine or horse, five pigs, ten sheep or 150 poultry).

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121 **2.2. Evaluation of compliance of own-check programmes and HACCP**

122 The researcher carried out a one-day visit to each small-scale SH between October 2015 to
123 January 2016 and evaluated the compliance of six different own-check programmes and HACCP
124 (Table 2). Evaluation of sampling included samples taken in own-check for microbiological analysis
125 of carcasses, cut meat, meat preparations, minced meat, and meat products. The evaluation also
126 included samples taken in own-check of water used in food production and cleaning and
127 microbiological hygiene monitoring of cleaned surfaces. Evaluation of animal by-products
128 comprised of by-products not intended for human consumption. These six own-check
129 programmes and HACCP were selected for this study because they were considered important for
130 food safety or were challenging for the FBOs (FVO 2013a, 2013b, 2013c & 2014a; Haltiala, 2013).

131

132 The evaluation of compliance of the own-check programmes and HACCP was carried out with the
133 help of a structured form and based on inspection of the own-check plan, including
134 microbiological sampling, certificates of analysis of samples, trade documents of non-edible by-
135 products and products, package labels, documented own-check results (e.g. temperature records),
136 and interviews with the FBOs. Evaluation of traceability included a traceability control from
137 slaughtered animal to products and conversely from products to slaughtered animals. The
138 evaluation of the compliance of the own-check programmes and HACCP was carried out on a four-
139 grade scale (4= good, 3=fairly good, 2=fairly poor, 1=poor) based on legislation (EC 852/2004, EC
140 853/2004, EC 1069/2009, EC 1169/2011) and national guidelines (Evira, 2009; 2015b; Evira, 2018)
141 where examples on how to assess the inspected items are given. In addition, the compliance of
142 seven different steps in developing and implementing of the HACCP system was evaluated on a
143 scale from one to three (completely done, partly done, not done).

144

145 **2.3. Food business operators' opinions of own-check programmes and HACCP**

146 During the visits to the SHs the FBOs assessed the necessity, laboriousness, and costs of the own-
147 check programmes on a scale from one to four (1=unnecessary/not laborious/no costs,
148 2=somewhat unnecessary/somewhat laborious/fairly low costs, 3=somewhat necessary/fairly
149 laborious/fairly high costs, 4=necessary/very laborious/very high costs).

150

151 **2.4. Electronic questionnaire for official veterinarians**

152 An electronic questionnaire examining compliance of own-check systems was sent in January 2016
153 to ten OVs responsible for the official control of the small-scale SHs participating in this study. The
154 questionnaire inquired about the OV's opinions on how well the own-check programmes and
155 HACCP that were evaluated in this study fulfilled the requirements set forth in the legislation and
156 guidelines given by Evira (Evira, 2009; 2015b; 2018). The scale was as follows: 4= good, 3=fairly
157 good, 2=fairly poor, 1=poor and based on Evira's instructions where examples are given on how to
158 assess the inspected items. It was also possible to elaborate on the answers in open-ended
159 questions. One reminder was sent.

160

161 **2.5. Statistical analysis**

162 Statistical analysis was performed using SPSS 23 (SPSS IBM, Armonk, NY, USA). The Mann-Whitney
163 test was used to analyse the significance of differences between the evaluations conducted by the
164 researcher and the OVs regarding own-check systems in eight small-scale SHs. This test was also
165 used to assess the significance between the compliance of small-scale SHs with an own-check plan
166 designed by the FBO or by a consultant. The correlation between compliance and opinions of the

FBOs of the own-check programmes and HACCP was tested with Spearman's rank-correlation test. A confidence level of 95% was applied when evaluating the results of statistical analyses.

3. Results

3.1. Compliance of own-check programmes and HACCP as evaluated by the researcher

The mean compliance of all six own-check programmes and HACCP varied greatly between small-scale SHs, from 2.1 to 3.6 (mean 2.8), as evaluated by the researcher. Mean compliance did not correlate with size (number of animal units) of the small-scale SHs (Spearman correlation $p>0.05$).

Own-check of temperature of storage rooms and traceability of products were assessed to fulfil the requirements most sufficiently (Table 2). Also the compliance of the non-edible by-products own-check was evaluated by the researcher to be fairly good (Table 2). Deficiencies in compliance of the non-edible by-products programme included inadequate staining of specified risk material (10/11) and insufficient or missing commercial documents (11/14). In labelling, the most serious deficiency was incorrect gluten-free marking (1/14). Other deficiencies in labelling were, for instance, incorrect last date for use or list of ingredients, missing identification mark, and misnaming of products (not customary or descriptive).

Compliance of the microbiological sampling programme was good in only three small-scale SHs (Table 2). Three small-scale SHs (numbers 5, 8, and 10) had taken all the microbiological samples from carcasses and meat cuts, whereas two small-scale SHs (numbers 11 and 14) had not taken any of these samples (Fig. 1A). Also three small-scale SHs (numbers 1, 6, and 8) had taken adequate numbers of samples of minced meat and meat preparations (Fig. 1B), whereas four SHs (numbers 9, 10, 13 and 14) had taken no samples from these items (Fig. 1B). The numbers of

Listeria monocytogenes samples were also adequate in three small-scale SHs (numbers 1, 3, and 8), while one small-scale SH (number 13) had not taken any *L. monocytogenes* samples (Fig. 1B). The samples of minced meat, meat preparations, and meat products that had been taken by FBOs did not consist of five partial samples, instead containing only one sample. The sampling of water used in food production and cleaning and the sampling for microbiological hygiene monitoring of cleaned surfaces were conducted well or fairly well in most of the small-scale SHs (12/14). Two small-scale SHs with fairly poor compliance had deficiencies in microbiological hygiene monitoring.

Own-check of temperature of raw and processed meat and HACCP were assessed to reach compliance most poorly (Table 2). The own-check description of temperature of carcasses or cut and/or minced meat was missing in eight and insufficient in two small-scale SHs. The own-check description of temperature of meat products was sufficient in four small-scale SHs (4/5). Monitoring of temperature of carcasses or cut and/or minced meat was not done at all in five small-scale SHs (5/14), and monitoring of meat products was insufficient in one small-scale SH (1/5).

The implementation of HACCP varied greatly between the small-scale SHs, and only one small-scale SH's HACCP was evaluated as good (Fig. 2). Only 50% (7/14) of the FBOs had described all product types and had flow diagrams of all of their processes. All FBOs had done a hazard analysis, but it was insufficient in nine small-scale SHs (9/14). Critical control points (CCPs) had not been identified in three small-scale SHs (3/14) (Fig. 2). Carcass cleanliness had been chosen as a CCP in 50% (7/14) of the small-scale SHs, and 80% (4/5) of the small-scale SHs had identified heat treatment as a CCP (Table 3). Nine CCPs (69%) were monitored, but monitoring was documented completely in only four (44%) of those CCPs. Only two of the FBOs had done verification and

validation of the HACCP programme by themselves. However, verification and validation had been done in 2014 by the OV in 50% (7/14) of the small-scale SHs (Fig. 2).

Half of the FBOs (7/14) had created and updated the own-check plan themselves, whereas half of them had an own-check plan devised by a consultant. No difference, nevertheless, was observed in the compliance of own-check programmes and HACCP between small-scale SHs in these two groups (Mann-Whitney test, p=0.62).

3.2. Food business operators' opinions of own-check programmes and HACCP

FBOs' opinions of the own-check programmes and HACCP were investigated to reveal possible associations of the opinions with the level of compliance. The most necessary own-check programmes according to the FBOs were related to the temperature of storage rooms, labelling, and traceability of products (Fig. 3). Compliance with temperature of storage rooms and traceability was also highest, although the correlation between the FBOs' perceived necessity and observed compliance was not statistically significant. HACCP was considered on average to be somewhat necessary, yet compliance was fairly poor or poor in more than half of the SHs (9/14), and a significant negative correlation was found between compliance of HACCP and laboriousness (r=-564, p=0.036, Spearman's rank-correlation test). Own-check of temperature control of raw and processed meat was evaluated as poor or fairly poor in half (7/14) of the SHs, although most of the FBOs (12/14) deemed it necessary or somewhat necessary. The highest costs were considered by the FBOs to be caused by sampling; compliance was also fairly poor concerning the microbiological sampling programme of carcasses, meat cuts, meat preparations, and meat products (mean 2.1).

3.3. Comparison of official veterinarians' and the researcher's evaluation of compliance of own-check programmes and HACCP

The response rate of the questionnaire to the OVs was 50% (5/10). These five OVs were responsible for the official control of eight (57%) of the small-scale SHs participating in this study. The size of these small-scale SHs varied between 35 and 900 slaughtered animal units, and the animals slaughtered included sheep, pigs, horses, poultry, lagomorphs, and wild and farmed game. The responders had 2-12 years of control experience with small-scale SHs.

The compliance of all own-check programmes and HACCP was assessed as higher by OVs than by the researcher. The difference in the evaluation of compliance was statistically significant concerning labelling, temperature control of raw and processed meat, and HACCP (Table 4).

4. Discussion

This study showed that small-scale SHs in Finland have persistent challenges in complying with food safety requirements. Poor compliance was observed in areas important for maintaining quality and safety of meat such as temperature control of meat and HACCP. When interpreting the results it should be kept in mind that the results are based on a small number of small-scale SHs. This sets challenges not only for statistical test, which need to be interpreted carefully, but also on the generalization of results. The results, however, are assumed to describe the status of the small-scale SHs in Finland fairly well. The study included one-third of the active small-scale SHs covering all regional areas except the Northern parts of the country. These results also support previous studies highlighting problems in complying with food safety legislation in small food businesses (Fielding, Ellis, Beveridge, & Peters, 2005, Charlebois & Summan, 2014; Buckley, 2015). Several factors, such as lack of money, time, knowledge, and attitude of the FBOs, have been

suggested to influence the compliance of own-check systems (Taylor, 2001; Yapp & Fairman, 2006; Ramalho, Pinto de Moura, & Cunha, 2015).

Because HACCP is considered important for food safety and implementation has been challenging, the EU has encouraged competent authorities to provide small-scale businesses with generic HACCP guidelines (European Commission Notice 2016/C 278/01). This has been done in Finland already years ago by issued instructions from both the authorities and the industry stakeholders to FBOs (Anonymous, 2006; Evira, 2008). Also advice is given to FBOs concerning food safety requirements during food safety inspections (Nevas et al. 2013). Despite these long-term efforts, the implementation is still inadequate in many small-scale SHs, and therefore, we argue that HACCP requirements should be re-evaluated and possibly simplified for small-scale SHs.

Own-check of carcass cleanliness, in particular, could be a target for simplification in small-scale SHs. Effective control of carcass cleanliness is of major importance for meat safety (Borch & Arinder, 2002), but our results show that only one FBO had completely implemented the HACCP-based monitoring and documentation. This can be due to laboriousness of implementing HACCP as the results revealed a negative correlation between compliance and the perceived laboriousness. We argue that the visual control of carcass cleanliness carried out by the FBO followed by the verification by the OV at post mortem inspection would ensure meat safety and be less complicated and laborious than HACCP. This could increase the motivation for the FBO to carry out a proper visual examination of the carcass cleanliness instead of struggling with a complicated and time-consuming HACCP procedure.

Another own-check programme that should be re-evaluated is the microbiological sampling. It seems that in Finland sampling frequency requirements are higher for small-scale SHs than in, for instance, the United Kingdom and Ireland (Food Standard Agency of England, 2016; Food Safety Authority of Ireland, 2014). Differences in sampling frequencies are, however, possible and even expected because EU regulation allows flexibility provided that the safety of foodstuffs will not be endangered (EC 2073/2005). In light of these findings and because sampling was reported to cause the highest costs of the own-check programmes, we recommend evaluation of whether all microbiological sampling requirements are justified from a food safety perspective. Any unnecessary costs should be avoided to increase the profitability of small-scale SHs.

Although many own-check programmes caused challenges for FBOs, traceability and control of storage temperature were properly implemented. Traceability can be complicated (Aung & Chang, 2014), but in these small-scale SHs the distribution chain was short and the number of different products few, which simplifies the management of traceability. Temperature control of the storage rooms is critical for meat safety, and it was considered, along with traceability, as necessary by the FBOs. However, our study revealed that the perceived necessity of an own-check programme did not necessarily lead to good compliance, as shown in the case of labelling and HACCP. Thus, the understanding of the importance of an own-check programme did not ensure compliance of the programme. An interesting finding was also that the utilization of consultants in designing the own-check plan did not result in better or poorer compliance. Other factors, such as laboriousness and costs, appeared to play more prominent roles.

Although the results of this study encourage re-evaluation of some of the own-check system requirements, it also raises the question of the quality of official control, as non-compliances were

310 common in small-scale SHs. The principal methods of official control are giving advice to FBOs
311 during inspections and, when advice is not followed, enforcement measures (Food Act, 2006). The
312 small-scale SH operators have earlier reported receiving sufficient advice (Kotisalo et al., 2015),
313 but it seems that this does not always result in compliance and further measures should be
314 applied more often.
315
316 Interestingly, the OVs assessed the compliance of small-scale SHs' own-check programmes and
317 HACCP as clearly higher than the researcher, possibly indicating a different understanding of
318 requirements or perception of food safety risks. The researcher noted issues as non-compliances
319 that were not in line with the legislation and instructions, which raises concerns. It is reasonable to
320 presume that an OV's perception of compliance affects the FBO's perception of compliance. Our
321 results suggest that it would be important to evaluate the official control in small-scale SHs, to
322 study the OVs' attitudes towards food safety requirements, and, if needed, to guide and provide
323 training to OVs.
324
325 To conclude, problems in compliance appear to arise from factors related to the FBO, OV, or
326 requirements of the own-check system. Small-scale SHs seem to have persistent challenges in
327 complying with several own-check programmes and HACCP despite issued instructions and on-site
328 guidance. The results of this study suggest that HACCP should be simplified to motivate FBOs to
329 perform proper visual control of the carcasses and the microbiological sampling schemes should
330 be re-evaluated to omit possible irrelevant samples. The official control should also be assessed to
331 increase efficacy. These results are applicable in Finnish context. However, as non-compliances
332 have been observed in other EU-countries as well, it would be important also in these countries to

assess if the food safety requirements are fit for purpose in small-scale slaughterhouses and the official control is efficacy.

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Figure captions

Figure 1 A and B.

Compliance with microbiological sampling requirements in 14 small-scale slaughterhouses (1-14). The numbers within the bar represent the number of samples taken /number of samples required. Number 8 is a poultry slaughterhouse and is not required to take carcass samples for total aerobic bacteria or enterobacteria.

Figure 2.

Implementation of HACCP (Hazard analysis and critical control points) in small-scale slaughterhouses (n=14).

CCP=critical control point.

Figure 3.

FBOs' (n=14) perceptions on the own-check programmes and HACCP (Hazard analysis and critical control points) and compliance of the programmes and HACCP evaluated by the researcher.

Perceived necessity of the programme and HACCP: 4=necessary, 3=somewhat necessary, 2=somewhat unnecessary, 1=unnecessary

Laboriousness of the programme and HACCP: 4=very laborious, 3=fairly laborious, 2=somewhat laborious, 1=not laborious

Costs of the programme and HACCP: 4=inflict very high costs, 3=fairly high costs, 2=fairly low costs, 1=no costs

Compliance of the programme and HACCP: 4=good, 3=fairly good, 2=fairly poor, 1=poor

Supplementary Figure 1.

Map of Regional State Administrative Agencies and number of small-scale slaughterhouses participating in the study / number of active small-scale slaughterhouses in Finland 2015 (Background map: National Land Survey of Finland 06/2018).

Figure 1.

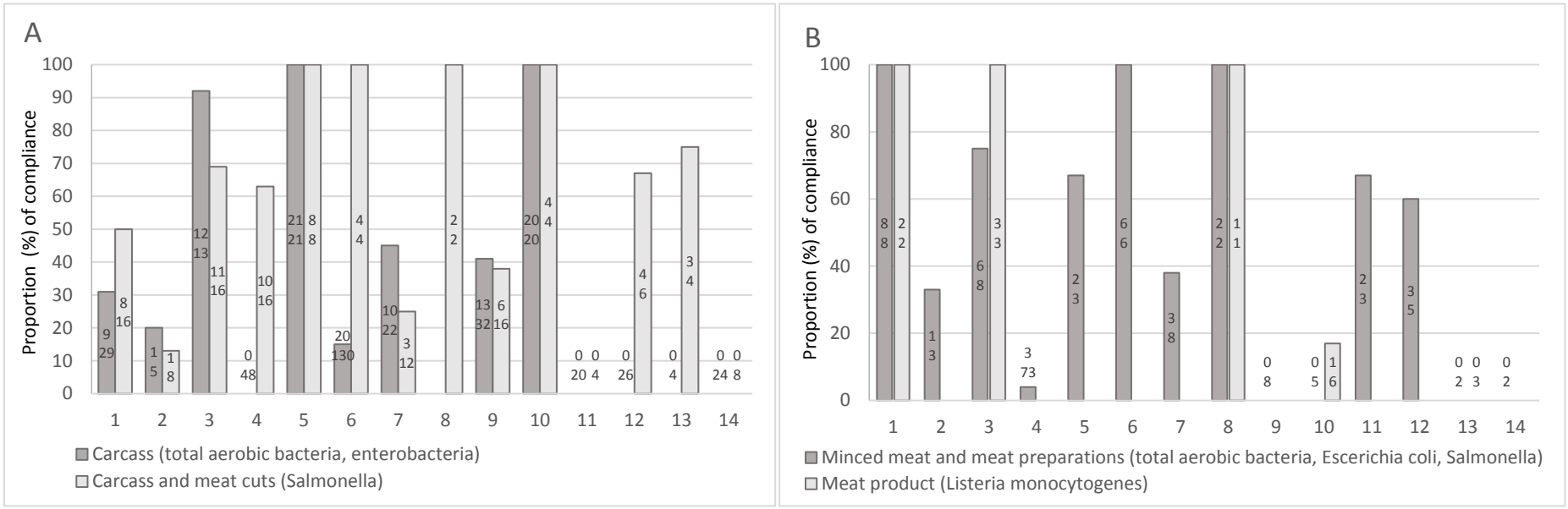

A
Proportion (%) of compliance
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
9 29
8 16
1 5
1 8
12 13
11 16
0 48
10 16
21 21
8 8
20 130
4 4
10 22
3 12
2 2
13 32
6 16
20 20
4 4
0 20
0 4
0 26
4 6
0 4
3 4
0 24
0 8
Carcass (total aerobic bacteria, enterobacteria)
Carcass and meat cuts (Salmonella)
B
Proportion (%) of compliance
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
8 8
2 2
1 3
6 8
3 3
3 73
2 3
6 6
3 8
2 2
1 1
0 8
0 5
1 6
2 3
3 5
0 2
0 3
0 2
Minced meat and meat preparations (total aerobic bacteria, Escerichia coli, Salmonella)
Meat product (Listeria monocytogenes)

Figure 2.

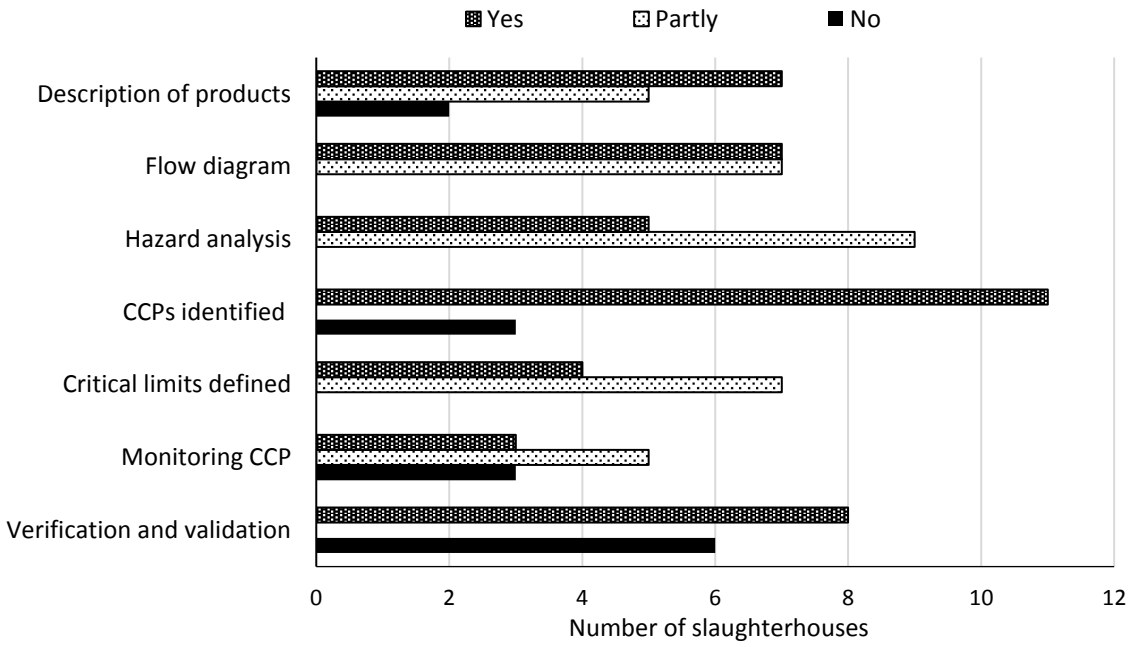
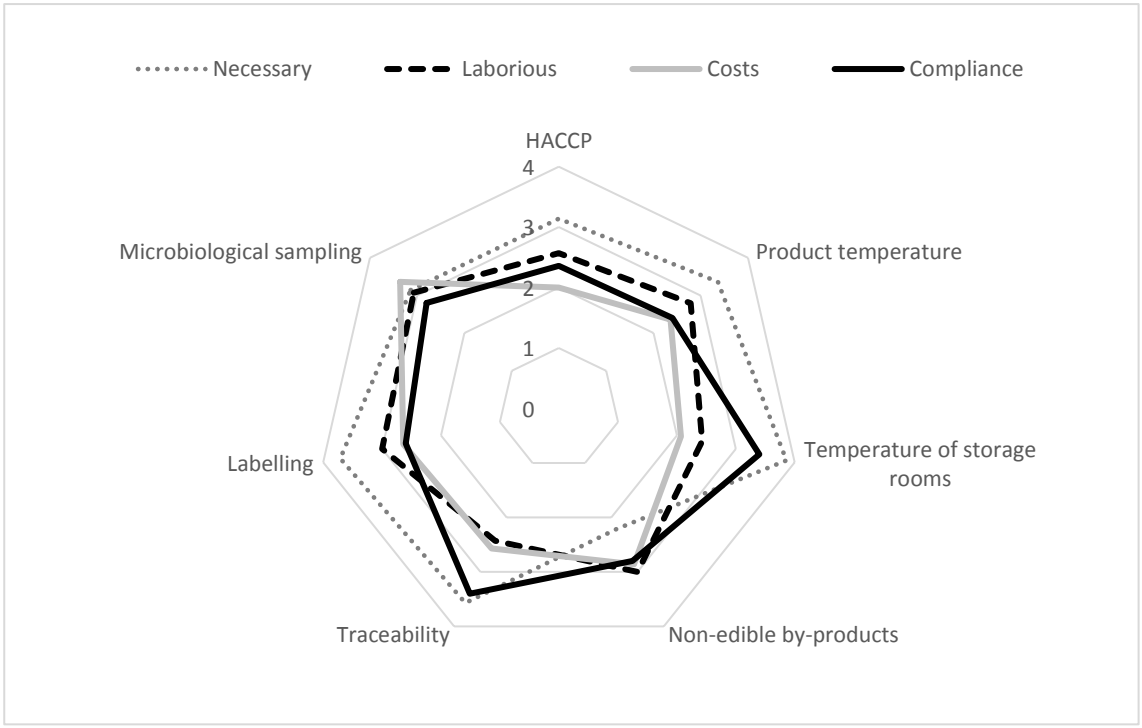

Yes
Partly
No
Description of products
Flow diagram
Hazard analysis
CCPs identified
Critical limits defined
Monitoring CCP
Verification and validation
0
2
4
6
8
10
12
Number of slaughterhouses

Figure 3.


Necessary
Laborious
Costs
Compliance
HACCP
4
3
2
1
0
Product temperature
Temperature of storage rooms
Non-edible by-products
Traceability
Labelling
Microbiological sampling

Supplementary material: map of Regional State Adminstrative Agencies and number of small-scale slaughterhouses participating in the study / number of active small-scale slaughterhouses in Finland 2015.

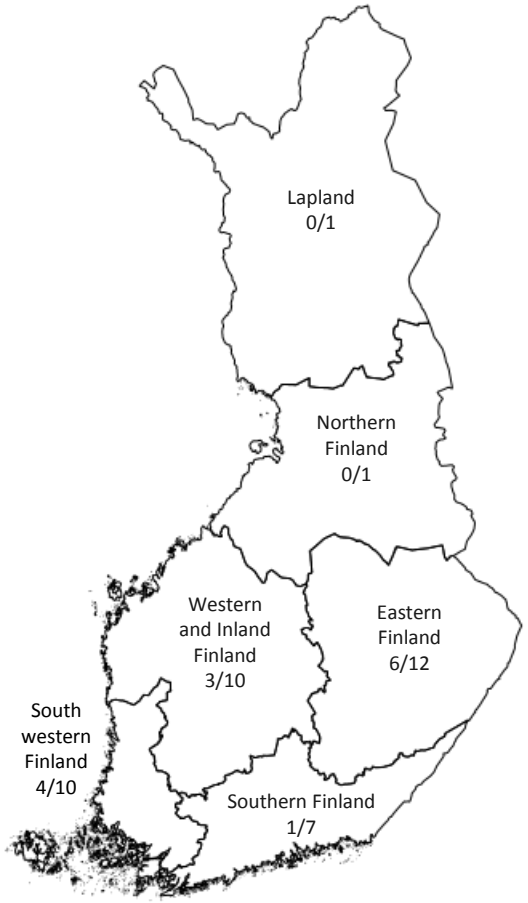


Table 1. Number and characterization of small-scale slaughterhouses (SHs) in Finland.

Regional State Administrative Agency	Number of active SHs	Number of active SHs having additional activities to slaughtering and cutting	Number of SHs included in the study	Slaughtered animal species in 2014 in SHs included in the study[a]						Activities in SHs included in the study	
				Sheep /goat	Pig	Bovine	Horse	Game	Poultry	Meat preparations (raw) and/or minced meat	Meat products (processed)
Eastern Finland	12	8	6	3	5	2	2	3	1	6	3
Southwestern Finland	10	5	4	3	2	2	1	1	0	4	2
Western and Inland Finland	10	6	3	3	2	2	2	2	0	3	0
Southern Finland	7	4	1	1	0	1	0	1	0	1	0
Northern Finland	1	1	0	0	0	0	0	0	0	0	0
Lapland	1	1	0	0	0	0	0	0	0	0	0
Total	41	25	14	10	9	7	5	7	1	14	5

[a]Ten small-scale SHs slaughtered more than one species.

Table 2. On-site evaluation of compliance of own-check system by the researcher in 14 small-scale slaughterhouses.

Own-check system	Compliance of small-scale slaughterhouses[a]				Mean compliance [b]
	Good	Fairly good	Fairly poor	Poor	
Own-check programme					
Temperature of storage rooms	8	4	2		3.4
Traceability	6	8			3.4
Non-edible by-products		11	3		2.8
Labelling		9	5		2.6
Microbiological sampling	3	4	5	2	2.6
Temperature of raw and processed meat	1	6	5	2	2.4
HACCP	1	4	8	1	2.4
Total	19	46	28	5	2.8

[a]Evaluation conducted based on EU and national food safety legislation, and instructions on compliance with legislation provided by the Finnish Food Safety Authority Evira.

[b]Good=4, Fairly good=3, Fairly poor=2, Poor=1

Table 3. Compliance of critical control points (CCPs) in small-scale slaughterhouses (SHs) (n=14) assessed by the researcher.

Process step	Number of SHs with a CCP (N)	CCP was monitored			Monitoring was documented		
		Comple-tely	Partly	No	Comple-tely	Partly	No
Controlling carcass for faecal contamination	7 (14)	4	0	3	1	1	2
Heat treatment of products	4 (5)	3	0	1	3	0	0
Cooling of carcass	1 (14)	1	0	0	0	0	1
Temperature of storage rooms	1(14)	1	0	0	0	1	0
Total		9	0	4	4	2	3

Table 4. Comparison of the evaluation (mean) between the researcher and the official veterinarian (OV) regarding compliance of own-check programmes and HACCP in eight small-scale slaughterhouses.

Own-check system	Evaluation by researcher on site[a]	Evaluation by OV[a,b]	p-value
Own-check programme			
Temperature of storage rooms	3.5	3.8	0.878
Traceability	3.4	3.9	0.105
Labelling	2.9	3.8*	0.002
Non-edible by-products	2.6	3.4	0.065
Temperature of raw and processed meat	2.4	3.6*	0.028
Microbiological sampling	2.4	3.4	0.083
HACCP	2.1	3.4*	0.007
Total	2.8	3.6*	0.000

[a]Evaluation conducted based on EU and national food safety legislation, and instructions on compliance with legislation provided by the Finnish Food Safety Authority Evira.

[b]Asterisk indicates a significant difference between the evaluation of the researcher and the OV (Mann-Whitney U-test, $p<0.05$).